51. IWK

Internationales Wissenschaftliches Kolloquium
International Scientific Colloquium

PROCEEDINGS 11-15 September 2006

FACULTY OF ELECTRICAL ENGINEERING AND INFORMATION SCIENCE

INFORMATION TECHNOLOGY AND ELECTRICAL ENGINEERING - DEVICES AND SYSTEMS, MATERIALS AND TECHNOLOGIES FOR THE FUTURE

Startseite / Index:
http://www.db-thueringen.de/servlets/DocumentServlet?id=12391

TECHNISCHE UNIVERSITÄT
ILMENAU

Impressum

Herausgeber: Der Rektor der Technischen Universität Ilmenau
Univ.-Prof. Dr. rer. nat. habil. Peter Scharff

Redaktion: Referat Marketing und Studentische Angelegenheiten
Andrea Schneider

Fakultät für Elektrotechnik und Informationstechnik
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Dipl.-Ing. Helge Drumm

Redaktionsschluss: 07. Juli 2006

Technische Realisierung (CD-Rom-Ausgabe):
Institut für Medientechnik an der TU Ilmenau
Dipl.-Ing. Christian Weigel
Dipl.-Ing. Marco Albrecht
Dipl.-Ing. Helge Drumm

Technische Realisierung (Online-Ausgabe):
Universitätsbibliothek Ilmenau
ilmedia
Postfach 10 05 65
98684 Ilmenau

Verlag:
Verlag ISLE, Betriebsstätte des ISLE e.V.
Werner-von-Siemens-Str. 16
98693 Ilrnenau

ISBN (Druckausgabe): 3-938843-15-2
ISBN (CD-Rom-Ausgabe): 3-938843-16-0

Startseite / Index:
http://www.db-thueringen.de/servlets/DocumentServlet?id=12391

51st Internationales Wissenschaftliches Kolloquium
Technische Universität Ilmenau
September 11 – 15, 2006

Josef A. Nossek

The Why and How of Multiple Antenna Systems
(Was heißt und zu welchem Ende studiert man Mehrantennensysteme?)

ABSTRACT

Systems with multiple antennas on both ends of a link are prominent candidates for future generations of mobile communication networks. The main motivation for such MIMO systems is the possibility to operate parallel streams at the same time in the same bandwidth. This aspect of a MIMO systems can be quantified by the so-called multiplexing gain. The multi-streaming mode of operation can lead to an increase in capacity, which is linear in the number of transmit or receive antennas, whichever is smaller. Given the same bandwidth and providing the same data rate a MIMO systems needs much less transmit power compared to a SISO systems. This not only greatly relaxing the required linearity of the transmit power amplifiers but also reduces interference in a multiuser scenario. Although the transmitter becomes simpler the nore parallel datastreams the MIMO system supports, this may be different for the receiver.

Since the main motivation of MIMO systems is bandwidth efficiency, the quantization associated with the A/D conversion may become a major issue. Important questions are: what is the capacity of a quantized MIMO system and how can we achieve this capacity? An answer to the first part of the question is straightforward, but the second part of the question is still an open problem for research.

But MIMO systems can provide alternative modes of operation leading to antenna gain and diversity gain. There is an elementary trade-off among these three performance gains of a MIMO system.

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